



## Cryoprotective effects of polyphosphates on *Rutilus frisii kutum* fillets during ice storage

Y. Etemadian<sup>a</sup>, B. Shabanpour<sup>a,\*</sup>, A.R. Sadeghi Mahoonak<sup>b</sup>, A. Shabani<sup>a</sup>, M. Alami<sup>b</sup>

<sup>a</sup> Faculty of Fisheries Science, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

<sup>b</sup> Department of Food Science and Technology, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

### ARTICLE INFO

#### Article history:

Received 24 March 2011

Received in revised form 25 May 2011

Accepted 2 June 2011

Available online 6 June 2011

#### Keywords:

Polyphosphate

Functional properties

Shelf life

Ice storage

### ABSTRACT

Polyphosphates have profound effects on the functional properties of the food products. In this study, the effects of (2% w/w) solutions of tetrasodium pyrophosphate (TSPP) and sodium tripolyphosphate (STPP) and a mixture of them on the shelf life of filleted *Rutilus frisii kutum* during ice storage were examined. Common zipper pouches were used for packing fish fillets. The packs were placed beside ice with a fish/ice ratio of 1:1 (w/w) in an insulated box and were maintained at 4 °C. The control and the treated packs were analysed periodically for chemical, microbiological (psychrophilic bacterial counts), textural and sensory characteristics. Control samples were found to have a shelf life of about 6 days, whereas samples treated with polyphosphate were found to be acceptable up to 9 days. Thus being treated with polyphosphates was found to delay the spoilage and extend the shelf life of *R.f. kutum* in ice.

© 2011 Elsevier Ltd. All rights reserved.

### 1. Introduction

*Rutilus frisii kutum* is one of the main fish species in the Caspian Sea, which due to its high nutritional quality and excellent sensory properties, is preferred by the customers in the north of Iran (Khanipour & Valipour, 2009). *R.f. kutum* is usually sold whole. In recent years as its demand has increased, its preservation quality has become more important. One way of preserving the fish is ice storage (Himelbloom, Crapo, Brown, Babbitt, & Reppond, 1994) but some undesirable changes may occur during ice storage, for example, denaturation of muscle proteins particularly myofibrillar proteins. Fish muscle proteins are less stable than those of beef, pork or poultry. Stabilising proteins may be achieved through cryoprotection or cryostabilisation. Cryoprotection is where low molecular weight compounds favour thermodynamically the maintenance of proteins in their native state. Cryostabilisation involves the use of high molecular weight polymers to raise the glass transition temperature (Kolbe & Kramer, 2007).

Polyphosphates are a common cryoprotectant and legally permitted additives that are widely used to aid processing or to improve eating quality of many foods, particularly meat and fish products (Aitken, 2001). Use of polyphosphates in seafood can increase water-holding capacity of muscle, decrease thaw drip and cooking loss (Chang & Regenstein, 1997; Turan, Kaya, & Erkoyuncu, 2003), improve textural properties of comminuted meat products (Zhuang, Savage, Smith, & Berrang, 2008), inhibit the growth of

bacteria in fish stored in ice and retard the oxidation of unsaturated fatty acids in seafood products (Masniyom, Sootawat, & Visessanguan, 2005). Therefore the use of such materials in refrigeration can play an effective role in maintaining fish quality.

### 2. Materials and methods

#### 2.1. Chemicals

Tetrasodium pyrophosphate (TSPP), sodium tripolyphosphate (STPP), potassium chloride, magnesium oxide, urea, tris-hydrochloride buffer (Tris-HCl), sodium dodecyl sulphate (SDS), ethylenediaminetetraacetic acid (EDTA), 5,5'-dithiobis(2-nitrobenzoic acid), sodium chloride, 2-thiobarbituric acid, sulphuric acid, boric acid, methyl red, bromocresol green, hydrochloric acid, sodium hydroxide, methanol, β-mercaptoethanol (βME) were purchased from Sigma Chemical Co. (St. Louis, MO) and all chemicals for electrophoresis were obtained from Bio-Rad (Richmond, CA).

#### 2.2. Fish preparation

*R.f. kutum* with an average weight of 800 g were caught in the Caspian Sea, Miankaleh, Iran in February 2010. Fish were placed in crushed ice with a fish/ice ratio of 1:3 (w/w) and transported to the fish processing laboratory of Gorgan University of Agricultural Sciences and Natural Resources within 2–3 h after being caught. They were then washed with tap water, filleted, skinned and cut into slices with a thickness of 1 cm. Fillets were combined at random to give a sample with a total weight of around 500 g.

\* Corresponding author. Tel.: +98 171 2245965; fax: +98 171 22425886.

E-mail address: [bshabanpour@yahoo.com](mailto:bshabanpour@yahoo.com) (B. Shabanpour).